Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.12013

Ore minerals in Martian meteorites: MIL 03346, NWA 5219, and NWA 13367

MACIEJ FITT[1], JAKUB CIAZELA[1], DARIUSZ MARCINIAK[1], MARINE PAQUET[2], MARTA CIAZELA[1], LESZEK LATACZ[3], MAGDALENA LABAN[1], KONRAD BLUTSTEIN[4], BEATA MARCINIAK-MALISZEWSKA[5], EWA SLABY[1] AND MARTA PRELL[6]

[1]Institute of Geological Sciences, Polish Academy of Sciences
[2]Institut de Physique du Globe de Paris
[3]CONNECT Leszek Latacz
[4]Department of Geology and Mineral Water, Wroclaw University of Science and Technology
[5]Faculty of Geology, University of Warsaw
[6]Institute of Geological Sciences, University of Wroclaw

Presenting Author: m.fitt@twarda.pan.pl

Ore minerals are crucial source of chalcophile and siderophile metals on Earth and this is expected also for Mars. In this study, using ore microscope, scanning electron microscope (SEM), and electron probe microanalyzer (EPMA), which will be completed by trace element and isotope measurements in the future, we investigate Martian meteorites in terms of their ore minerals and metal inventory to understand ore formation and their distribution on Mars. Our first results concern four samples including one nakhlite (MIL 03346) and three shergottites (two samples of NWA 5219 and one NWA 13367).

MIL 03346 consists of 75.0% clinopyroxene, 23.0% mesostasis, 1.5% olivine, and 0.5% ore minerals. Among the ore minerals, Fe-Ti oxides are the most abundant (0.49% of the whole area). Remaining 0.01% is pyrrhotite with a metal/sulfur ratio 0.88-0.90. Clinopyroxenes are augites, showing distinct zonation from $Fs_{23}Wo_{40}En_{37}$ in the core towards $Fs_{46}Wo_{33}En_{21}$ on the rims. Olivine megacrysts are Fo_{42} in the cores with Fo_{20} rims, while tiny mesostasis olivines are Fo_{5}.

Basaltic shergottite NWA 5219 contains 67.7% clinopyroxene, 29.8% maskelynite, 1.6% merrillite, and 0.9% ore minerals [oxides (ilmenite, ulvöspinel, baddeleyite): 0.75%; sulfide (pyrrhotite): 0.15%]. Ilmenite is about 6.5 times more abundant than ulvöspinel. Pyrrhotite has a metal/sulfur ratio of 0.90–0.98. Clinopyroxenes range from augite ($Fs_{25-26}Wo_{31-32}En_{42-43}$) to pigeonite ($Fs_{40-61}Wo_{11-16}En_{27-45}$) compositions.

NWA 13367 is a ultramafic shergottite, with 47.8% olivine, 35.6% clinopyroxene, 12.5% maskelynite, 3.0% merrillite, and 1.1% ore minerals. Oxide (ilmenite and chromite) and pyrrhotite modal abundances are 1.0% and 0.1%, respectively. Pyrrhotite rarely contains pentlandite exsolutions. The metal/sulfur ratio in pyrrhotite is 0.95–0.99. Olivine grains are Fo_{62-65} and clinopyroxenes are $Fs_{27-31}Wo_{7-14}En_{58-63}$ augite.

The entire study will include 15 meteorites, which will be then analyzed in the context of large-scale remote sensing data to find out how magmatic and secondary processes affect ore deposits formation on Mars and to identify the most probable sites of their occurrence.

This research was funded by National Science Centre of Poland, grant no. 2020/37/B/ST10/1420